Geophysical Research Abstracts
Vol. 17, EGU2015-346, 2015
EGU General Assembly 2015

Insights into the sub-plinian eruption of a basaltic monogenetic volcano using different analytical methods

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The basaltic monogenetic La Vache and Lassolas cone complex in the Chaîne des Puys, France, erupted about 8600 years ago in a sub-plinian event, producing simultaneously a $>25 km^2$ widespread tephra fall deposit, two scoria cones and ca. 15km long lava flow. By detailed sampling and studying of the tephra deposit we were able to determine variations within the 8m thick, mostly massive proximal sections. Shape analysis of the coarse ash fraction was performed using the G3 morpho-grainsizer at the Laboratoire Magmas et Volcans. This instrument has the great advantage to permit analysis of the shape parameters of up to 3000 particles, depending on the grain size, in a relative short time frame of half an hour. With this new technique it is now possible to analyse a large number of samples with a statistically significant number of particles. We present here the results of the analysis of two different particles size classes (250-300μm and 1000-1180μm). The results indicate variations in the shape parameters that correlate with variations in the grain size throughout the eruption sequence that were identified using grain size analysis. Detailed componentry analysis reveal that these variations in the shape parameters may be caused by changing amounts of three different clast types: sub-rounded, lithic granitic clasts, spherical, non-vesicular juvenile clasts, and ragged, vesicular juvenile clasts. The two different juvenile clast types raise questions about their formation processes. For further characterisation of the juvenile clasts density measurements were performed on the larger size fraction, displaying densities of 0.7-2.2 g/cm^3 for the spherical, non-vesicular clasts and densities of 0.5-1.9 gr/cm^3 for the ragged, vesicular clasts. Apart from the density values around 2.2 $g/cm^3$of some of the spherical juvenile clasts that are considered to be the result of large phenocryst cores inside the spherical clasts, both juvenile clast types are similar in their range of densities. The observed differences in the vesicularity of the clasts imply that the non-vesicular spherical clasts are micro-vesicular. However, further textural analysis are needed to answer the question of the formation process of these clasts. This study shows that shape analysis in combination with detailed tephra studies can reveal subtle variations in massive deposits and can give insights into eruption dynamics.